Seasonal Methylmercury Export from the Hells Canyon Reservoir Complex, Idaho and Oregon, USA

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Anoxia in the hypolimnion of lakes and reservoirs can promote the conversion of mercury (Hg) to the more toxic methylmercury (MeHg) form. In the 200-km Hells Canyon Reservoir Complex (HCRC) along the Snake River (Idaho-Oregon border), three deep (up to 90 m) reservoirs seasonally stratify for months at a time, creating anoxic conditions that promote MeHg production in the water column. The fate of the accumulated MeHg after reservoir destratification is unknown.

In 2014, the U.S. Geological Survey, Idaho Power Company, and the Idaho Department of Environmental Quality initiated a collaborative investigation of Hg cycling and fate in the HCRC. The primary research objectives for this project include understanding the mechanisms promoting in-reservoir MeHg production, and the fate of the MeHg accumulated in the water column following reservoir destratification. To help address these objectives, the mass flux of Hg and MeHg into, within, and out of the HCRC was estimated using discrete water-quality data and streamflow into and out of each reservoir.

Water samples were collected biweekly from four reservoir inflow/outflow locations between 2014 and 2018 and analyzed for dissolved and particulate Hg and MeHg. Continuous streamflow data collected at the inflow and outflow of each of the three reservoirs were used in conjunction with the concentration data to develop regression models relating instantaneous Hg and MeHg loads to mean daily streamflow and seasonal variables. The resultant models were used to estimate the inflow and outflow loads of Hg and MeHg in the water column for each reservoir and for the HCRC as a whole. Despite clear seasonal in-reservoir production and export of dissolved MeHg from the HCRC, mass balance results indicate that total Hg inflow to the HCRC is ~2.9x greater than outflow, and MeHg inflow is ~1.6x greater than outflow. Thus, overall, the HCRC acts as a sink with respect to Hg and MeHg in the water column. Findings from this study are intended to help manage the HCRC to minimize downstream export of Hg and MeHg.